

Appl. No. : 09/975,466
Filed : October 9, 2001

REMARKS

Claims 1-17, 28 and 30-32 are pending in the present application. Claims 6 and 7 were found to be allowable if rewritten in independent form. Claims 6 and 7 have been amended herein to incorporate the subject matter of Claim 1. Note that while Claims 6 and 7 each previously depended from Claim 4, Claim 4 was not incorporated into rewritten Claims 6 and 7 to avoid redundancy. These amendments do not add new matter.

Claim rejections under 35 U.S.C. §103

Claims 1, 3-5, 8-17, 28 and 30-32 were rejected under 35 U.S.C. §103 as obvious over the combination of Sundararajan et al. (U.S. Patent Application 2002/0027286) and Donnelly Jr. et al. (U.S. Patent No. 6,143,658). Claims 2 and 31 were rejected over this combination further in view of what the Examiner characterizes as admitted prior art.

In making the rejections, the Examiner found that Sundararajan et al. discloses a process for producing an integrated circuit comprising forming a damascene structure on a substrate, forming copper oxide on the copper during CMP and reducing copper oxide by contact with hydrogen or ammonia plasma. It was found that Sundararajan et al. does not teach reducing copper oxide with an organic, vapor-phase reducing agent that is not plasma activated.

The Examiner argues that Donnelly Jr. et al. teaches “vapor phase reduction of copper oxide using an organic reducing agent, specifically H(hfac) or hydrogen hexafluoroacetylacetone...” The Examiner concludes that it would have been obvious to “use the organic vapor phase reducing agent of Donnelly after the hydrogen plasma of Sundararajan because Donnelly teaches that the organic, vapor phase reducing agent after hydrogen plasma treatment results in better adhesion of the metal layer...’

Applicants respectfully submit that the Examiner has mischaracterized Donnelly Jr. et al. and that the deficiencies of Sundararajan et al. are not made up for by the teachings of the secondary reference. Donnelly Jr. et al. does not teach the *reduction* of copper oxide with a vapor phase organic *reducing agent*. To the contrary, the teachings of Donnelly Jr. et al. are limited to *etching* of copper oxide with H(hfac). H(hfac) is an etchant that *removes* copper oxide from the surface to the gas phase. H(hfac) reacts with copper oxide and forms volatile copper hexafluoroacetylacetone and water. H(hfac) *does not have reducing activity*. The etching process utilizing H(hfac) has been described, for example, in U.S. Patent No. 5,939,334 (see, for

Appl. No. : 09/975,466
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example, column 5, line 53 through column 6, line 26) and in Satta et al. (J. Electro. Soc. 150:G300-G306 (2003), copies of each of which are attached for the Examiner's convenience.

Claim 1 of the present application recites a process for producing an integrated circuit comprising *reducing* copper oxide on a substrate by exposure to one or more vapor phase *organic reducing agents*. The claim does not simply recite *removing* copper oxide. Similarly, Claim 28 recites contacting the substrate with one or more organic vapor phase *reducing agents*.

As Donnelley Jr. et al. does not teach or suggest *reducing* copper oxide with a vapor phase organic *reducing agent*, Applicants submit that the present rejection under 35 U.S.C. §103 should be withdrawn.

Double Patenting

Claims 1, 3-5, 8-17, 28, 30 and 32 were rejected under the judicially created doctrine of obviousness-type double patenting as unpatentable over Claim 3 of U.S. Patent No. 6,482,740 (the '740 patent) in view of Sundararajan et al. In making the rejection, the Examiner found that at the time of the invention, it would have been obvious to use the method of Claim 3 of the '740 patent to form an integrated circuit because Sundararajan et al. teaches that copper deposition is highly desired to form damascene wiring interconnects.

Applicants respectfully disagree and submit that the Examiner has not provided the necessary motivation to support the asserted combination. Nevertheless, solely to facilitate prosecution Applicants submit herewith a Terminal Disclaimer over U.S. Patent No. 6,482,740. In view of the Terminal Disclaimer, Applicants request withdrawal of this rejection.

Appl. No. : 09/975,466
Filed : October 9, 2001

Conclusion

In view of the amendments and arguments presented above, Applicants submit that the present application is in condition for allowance. If any issues remain, the Examiner is cordially invited to contact Applicants' representative at the number provided below in order to resolve such issues promptly.

Respectfully submitted,

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